ARCO Coal Company
555 Seventeenth Street
Denver, Colorado 80202
Telephone 303 293 4272

Richard Kraolin, Ph.D.
Manager
Environmental Projects

October 26, 1989

Mr. Jonathan Z. Cannon
Acting Assistant Administrator
Office of Solid Waste and Emergency Response
U.S. Environmental Protection Agency
401 M Street, S.W.
Washington, D.C. 20460

Dear Mr. Cannon:

ARCO Coal Company, a division of Atlantic Richfield Company, submits the attached comments on EPA's "Interim Guidance on Establishing Soil Lead Cleanup Levels at Superfund Sites" (OSWER Directive #9355.4-02), dated September 7, 1989. The Directive sets a cleanup level of 500-1,000 ppm for total lead which the EPA considers protective for direct contact in residential settings.

EPA states that it is adopting a recommendation ("...lead in soil and dust appears to be responsible for blood levels in children increasing above background levels when the concentration in the soil and dust exceeds 500 to 1000 ppm") contained in the 1985 Centers for Disease Control (CDC) document "Preventing Lead Poisoning in Young Children." Review of this document and personal communication with CDC staff indicate that CDC never intended the 500 to 1000 ppm statement to be considered a "recommendation" and adopted as a soil cleanup level. There is no scientific documentation in the CDC document or the EPA Directive to support the interim cleanup level.

Scientific justification must be provided by EPA in order to assure that any soil lead cleanup level is adequate to protect health. The Directive improperly rejects use of the EPA Integrated Uptake Biokinetic Model which has been demonstrated to be a reliable analytical method to determine the relationship between environmental lead concentrations and blood lead concentrations in EPA lead rulemaking. In addition, the Directive has not considered background blood lead levels, target blood lead levels after cleanup, population of primary concern, fraction of the population to be protected, nature and severity of health effects and factors which influence the bioavailability of lead.

If EPA uses the guidance document as it appears it was intended, the above inadequacies could be at least partially remedied by site-specific studies, as in an RI/FS leading to a remedial action. However, Region VIII intends to use the guidance as if it were a regulation, applying lead cleanup levels without site-specific study.

ARCO understands EPA's need to set cleanup standards and to move forward with Superfund cleanups as expeditiously as possible. Yet, the basis of a soil cleanup level for lead must be scientifically valid. Absent such validation, we urge EPA to hold off on actions proposed to be conducted without regard to establishing a scientific basis. Shortly, we will be sending you a proposed methodology for deriving site specific soil lead cleanup levels. Our methodology will include such factors as identification of the exposed population, determining background blood lead concentrations, blood lead levels contributed from soil, health criteria, fraction of the population to be protected and bioavailability. We would appreciate the opportunity to meet with you to discuss our methodology when it is completed.

We look forward to hearing from you at your earliest convenience regarding the attachment and anticipate further discussion on soil lead cleanup methodology.

Sincerely,

Richard Krablin, Ph.D.
Manager
Environmental Projects

Attachment

pc: J. L. Scherer/U.S. EPA
W. K. Reilly/U.S. EPA
H. L. Longest II/U.S. EPA
B. Diamond/U.S. EPA

bpc: D. E. Pizzini/Montana Department of Health & Environmental Sciences
K. Alkema/Utah Department of Health
T. Vernon/Colorado Department of Health
J. F. Wardell/EPA
R. L. Duprey/EPA

bpc: P. D. Bergstrom
H. L. Bilhartz
R. L. Dent
J. H. Desautels
L. D. Milner
E. C. Tidball
W. R. Williams
B. L. Murphy/Gradient
G. N. Bigham/PTI

ATTACHMENT TO LETTER TO JONATHAN Z. CANNON
DATED OCTOBER 26, 1989

Comments on "Interim Guidance on Establishing Soil Lead Cleanup Levels at Superfund Sites" (U.S. EPA, September 7, 1989)

Introduction

On September 7, 1989, the Offices of Emergency and Remedial Response and of Waste Programs Enforcement of the U.S. Environmental Protection Agency (EPA) issued a directive setting interim soil cleanup levels for lead at Superfund sites (Longest and Diamond, 1989). The stated range of soil lead concentrations (500 to 1,000 ppm) is considered by these Offices to be "protective for direct contact at residential settings." The directive further states that additional soil cleanup guidance will be developed after the development of standard toxicity factors for lead (i.e., a Cancer Potency Factor and/or a Reference Dose for non-cancer health effects.)

The Agency's establishment of this cleanup range, as presented in the September 7 directive, suffers from numerous methodological and technical deficiencies. From a methodological perspective, the Agency provides little basis for selection of this range.

Instead, EPA states that it is adopting a "recommendation" of the Centers for Disease Control (CDC). The EPA directive provides no discussion of the target blood lead levels which would be expected following exposures to the soil cleanup levels, of the population of primary concern, or of the fraction of the population that would be protected by use of these guidelines.

EPA's inadequate technical basis is likely to reflect the limited technical justification provided by CDC in its derivation of this range (U.S. DHHS, 1985). As presented in both the EPA directive and the original CDC document to which the directive refers, the 500-1,000 ppm range is one which "appears to be responsible for blood lead levels in children increasing above background levels." Neither CDC nor EPA discuss critical factors for application of this soil lead range to site cleanup. Factors which should be considered include the magnitude of expected increase above background blood lead, the background blood lead level assumed, the nature and severity of health effects (if any) associated with such increases, or the individual and population significance of these health effects. Factors which influence the bioavailability of lead at specific sites, such as impacts of soil or other matrix composition (e.g., mining wastes), on lead uptake must also be considered. These concerns are presented in more detail in Comments 2 and 3 below.

In addition to providing insufficient technical justification for the values it has selected, the Agency's approach to setting these interim guidance levels ignores or inappropriately dismisses substantial available information on lead toxicity, exposure, and risk. In particular, EPA fails to acknowledge significant differences in exposure mechanisms between fetuses (the primary population of concern for low-level lead exposures -- whose exposure is determined by maternal exposures) and young children (who have the most significant exposures to soil/dust lead due to enhanced soil/dust ingestion rates). The Agency also improperly rejects the use of the Integrated Uptake/Biokinetic (IU/BK) model, which provides important insights into the relationships between environmental concentrations of lead and blood lead levels. While EPA acknowledges the importance of consideration of relative bioavailability of different forms and particle sizes of lead, these data are not incorporated into the current cleanup guidance.

These comments as well as the appropriate incorporation of the IU/BK model and other generic and site-specific data into development of cleanup levels for lead are discussed in more detail below.

1 Numerous methodological and technical deficiencies exist in EPA's documentation of its interim soil cleanup levels for lead in soil.

One of the most significant problems with EPA's proposed interim soil lead cleanup guidelines is its failure to provide either the rationale or bases for selection of the 500-1,000 ppm range as the range of concern. The Agency does not identify the population to be protected by these cleanup levels, e.g., young children with elevated soil ingestion rates or fetuses who may be more susceptible to the neurological effects associated with lead exposures. EPA also does not relate the soil cleanup levels to blood lead levels or adverse health impacts of concern, i.e., the adverse health impacts which would be avoided or mitigated by adhering to these cleanup levels are not specified. Information on the level of protection, e.g., the fraction of the exposed population which would not experience a particular adverse health impact or which would not exceed a certain blood lead level of concern, also is not provided in the directive.

The failure to present such information raises questions regarding the scientific validity of the selected soil concentration range. In addition, vagueness regarding the derivation procedures for the cleanup values presents difficulties for selecting specific site cleanup levels either within or outside the range. For example, the Agency acknowledges that "[s]ite-specific conditions may warrant the use of soil cleanup levels" which are not within the stated range. However, without any guidance as to the factors incorporated into the initial selection of the stated range, it is unclear how selection of a value within the range or modification of these cleanup levels could be undertaken. As discussed in Comment 3 below, site-specific considerations are likely to be significant enough to negate the usefulness of generic cleanup levels in favor of site-specific measures for all sites.

The absence of supporting information in EPA's guidance reflects the limited basis for derivation by CDC of the soil levels cited by EPA. As described in more detail in Comment 2 below, EPA's use of CDC's values is technically inappropriate as the soil levels were not necessarily associated with any adverse health impacts, but were merely described as being levels which appeared to elevate children's blood lead levels "above background." Other technical factors limiting the applicability of CDC's values for CERCLA use are decreases in children's blood lead levels since the time of CDC's assessment, and differences in the types of sites reviewed by CDC (largely urban conditions including lead paint exposures) compared with those for which the cleanup levels are intended (CERCLA hazardous waste sites, including mining sites). It should also be noted that there is no indication CDC ever intended these soil values to serve as cleanup guides (CDC, 1985).

EPA attempts to provide some justification for its wholesale adoption of CDC's values by stating that the use of this range is only an interim measure. Additional guidance is to be provided by the Agency after it has finalized its reviews of development of a Cancer Potency Factor (CPF) or a Reference Dose (RfD) for lead. While recently evolving data on the health impacts of lead certainly merit systematic review by EPA (e.g., toxicity factor development processes), the failure to have completed these reviews does not justify proposal of soil cleanup levels which neither have a well-documented technical support nor acknowledge the substantial technically-based guidance alternatives which are currently available. These include use of the IU/BK model together with exposure and site-specific considerations in identifying populations of primary concern and levels of exposure and risk. Such information has already undergone extensive review and compilation by several EPA offices as well as other Federal agencies (U.S. EPA, 1989a, 1989b, 1986; U.S. DHHS, 1988, 1985).

These factors, and their appropriate application in developing soil cleanup levels, are discussed in Comment 3 below. It should also be noted that, as acknowledged by EPA's Clean Air Scientific Advisory Committee (CASAC) Joint Lead Group meeting of April 27-28, 1989, the data base for neurological effects on children is vastly more extensive than that for lead carcinogenicity. Thus, even if quantification of carcinogenic potency for lead indicates comparable exposure levels of concern, neurological endpoints are likely to remain the primary focus of concern at sites where children may be exposed to lead contaminated soils.

2 <u>EPA's application of CDC's soil lead values for use as cleanup levels is both technically deficient and extends the use of these values well beyond the uses intended by CDC.</u>

As noted above, EPA does not provide documentation of the scientific rationale for the soil cleanup levels announced in its September 7, 1989 directive, but instead claims that the guidance adopts a "recommendation" generated by the CDC. The section quoted by

EPA as a "recommendation," however, appears in the 1985 CDC document Preventing Lead Poisoning in Young Children, under the heading "Sources of Lead Exposure." Examination of the information provided in this document as well as contacts with CDC staff provides no indication that CDC either intended these levels to be interpreted as levels of concern for adverse health effects or as levels to be used in establishing site cleanup standards. In other words, CDC did not make a "recommendation" at all.

As quoted in EPA's directive, the CDC document specifically states that "...lead in soil and dust appears to be responsible for blood levels in children increasing above background levels when the concentration in the soil or dust exceeds 500 to 1,000 ppm." No indication is provided of the background level used or of any potential occurrence of adverse effects following exposure to soil or dust lead levels in this range. With no index to either the magnitude of increase in blood lead from exposure or to anticipated health effects of such exposures, the CDC statement is merely an observation of a statistical measure. It provides no indication that exposure to the stated range of soil and dust lead levels will result in blood lead levels of health significance.

In addition, CDC provides no documentation of the derivation of their statement that blood lead levels increase with soil lead levels greater than 500-1,000 ppm. In personal communication, CDC staff indicated that the statement was intentionally not referenced. Instead, the committee preparing the CDC document provided this statement merely as a reflection of professional judgment regarding the impacts of soil and dust lead on blood lead. The committee never intended for the information provided to be used as a regulation.

It should also be noted that background blood lead levels in the U.S. have decreased since the time at which the CDC report was issued. As outlined in Appendix C of the OAQPS Staff Report on lead (U.S. EPA 1989a), sources of lead that contribute to background levels of blood lead in the population have been decreasing since at least 1978. The changes that have been observed are partly due to the phase-down in use of leaded gasoline. This phase-down has been paralleled by a decline in blood lead levels, which is anticipated to continue into the 1990s. Similarly, dietary intake of lead has been decreasing since the late 1970s, and should continue to decrease as atmospheric deposition of lead onto foods, use of lead-soldered cans, and drinking water levels of lead all continue to decline. With the impact of these changes, EPA estimates that the 1990 baseline average blood lead levels for two year old children will be 28 to 35 percent of the baseline in 1978.

These changes in background levels would alter the significance of CDC's statement in terms of the blood lead levels which would result from exposures to soil and dust with lead concentrations of 500-1,000 ppm as well as in terms of the health impacts which might be expected. Since, as discussed above, no documentation is provided by CDC for blood lead levels or anticipated health effects, the impacts of changes in background blood lead levels on their view of these soil/dust concentrations is difficult to assess.

Another difference between the CDC derivation of the soil lead concentration of concern and EPA's intended use of this range is the types of sites, and thus the types of lead, involved. CDC's review focused mainly on smelter sites and sites with typical urban lead exposures, including lead-based paints. The site cleanup levels will be applied to CERCLA sites, including mining sites. As discussed in Comment 3 below, evidence exists indicating differential absorption of lead derived from different sources. Variations in outdoor/indoor transfer of lead for different site types may also influence application of the CDC range to CERCLA sites as the CDC evaluation looked at soil and dust exposures together, without segregating their individual effects. These factor may further increase the inappropriateness of EPA's adoption of the CDC values.

The EPA directive, in adopting the CDC soil range for cleanups at hazardous waste sites, clearly has extended the use of these values well beyond their original intended purpose. Differences between the types of sites reviewed by CDC and those for which cleanup levels would be applied, as well as changes in background blood lead levels since the time of derivation of CDC's values, were not acknowledged by the Agency. Most importantly, EPA failed to provide a scientific basis for application of these values or to link exposures in excess of the suggested levels with adverse health effects.

3 EPA's soil cleanup levels fail to incorporate available modeling procedures and toxicological and site-specific data which must be considered in developing soil cleanup levels for lead-contaminated sites.

3.1 Exposure Considerations in Setting Soil Cleanup Levels

As noted above, EPA's guidance fails to identify the population to be protected by the stated cleanup levels. For residential settings, the stated setting of concern in the September 7 guidance, young children have been the primary population at risk due to exposure to lead-contaminated soils. This is due to their increased susceptibility to the neurological effects of lead (as compared to adults) as well as the likelihood of their greater exposure to lead, especially via soil ingestion.

Recently, increasing concern has been expressed over neurological impacts observed following prenatal exposures to lead at blood lead levels (10-15 μg/dl) which are lower than those previously thought to be acceptable for postnatal exposures for young children (25 μg/dl). While such impacts may exist, it must be recognized that the exposure pathway for fetuses from lead-contaminated soils is substantially different from that for young children. Specifically, while young children may directly ingest lead-contaminated soils, fetuses are only exposed to lead-contaminated soils via maternal ingestion and contact. Because young children are known to have enhanced soil ingestion rates as well as higher lead absorption and retention rates compared to older children and adults, fetal exposures (via maternal exposures) to lead-contaminated soils will be much less than young child exposures. It is likely that the difference in magnitude of exposures may more than account for any difference in susceptibility to lead exposures (as indicated by blood lead levels) that may exist between fetuses and young children. By ignoring these factors, EPA has failed to develop soil cleanup criteria for lead-contaminated sites based on a consistent description of exposed populations of concern, exposure pathways, and acceptable exposure criteria.

3.2 Appropriate Use of Uptake Factors and Models in Setting Soil Cleanup Levels

In setting the current soil cleanup levels, EPA has dismissed the use of biokinetic uptake models, stating that such models may only be used where extensive environmental and biological data are available. This approach disregards the important contributions that such models can make towards understanding the interrelationships between environmental exposures, human body burden, and health impacts. It is also inconsistent with efforts being made in other parts of the Agency as well as by other groups. For example, in proposing a Maximum Contaminant Level (MCL) for lead in drinking water, EPA's Office of Drinking Water applied an uptake factor relating lead intake via water to blood lead levels (U.S. EPA, 1988). Similarly, the Task Force of the Society of Environmental

Geochemistry and Health is developing a methodology for establishing soil cleanup levels which incorporates information on the relationship between soil lead and blood lead (Wixson, 1989).

One of the most intensively evaluated models of this type is the Integrated Uptake/Biokinetic Model (IU/BK), which quantifies the relationship between environmental (i.e., air, dust/soil) and dietary lead levels and the associated blood lead levels. This model was selected by the U.S. EPA Office of Air Quality Planning and Standards (OAQPS) as a regulatory tool in setting a National Ambient Air Quality Standard (NAAQS) for lead. For this standard setting process, OAQPS is using the model to predict blood lead concentrations in children under different exposure conditions (U.S. EPA, 1989a).

The uptake portion of the model, developed by Kneip et al. (1983), accepts site-specific data or default values for lead levels in each medium and combines this information with assumptions regarding behavioral and physiological parameters (i.e., time spent indoors and outdoors, time spent sleeping, diet, dust/soil ingestion rates, daily breathing volumes, deposition efficiency in the respiratory tract, and absorption efficiency in the respiratory tract and gastrointestinal tracts (U.S. EPA, 1989b)). The biokinetic portion of the model (Harley and Kneip, 1985) accepts uptake predictions and computes age-specific blood lead levels based on a six-compartment biokinetic model of tissue distribution and excretion of lead (U.S. EPA, 1989b). Overall, the IU/BK model is very versatile in that the default assumptions and values on which uptake rate and blood lead calculations are based can be replaced with available site-specific data or revised defaults. Thus, the model can be updated as new information on exposure levels, intake and uptake parameters become available.

To apply the model, a baseline blood lead level representing routine exposures to lead in food, air, and water is compiled. Then, the contributions to blood lead from exposure to housedust and soil are added to the baseline. The IU/BK model is then used to calculate mean blood levels by multiplying estimated lead input rates (in μg/day) by age-specific biokinetic slope factors (BSF, in μg/dL per μg/day). The mean blood lead levels can then be used to estimate the frequency distribution, a useful parameter for risk assessment purposes, for lead levels in populations of children (U.S. EPA, 1989b).

The results of several validation exercises conducted by the U.S. EPA for the IU/BK model (Figures 1 and 2) indicate that the model accurately predicts mean blood lead levels and population distributions associated with multimedia exposures in children (U.S. EPA, 1989a). These analyses assume a soil ingestion rate of 80-135 mg/day and 25% gastrointestinal absorption of lead from soil. Figure 1 shows that when site-specific data for air, dust, and soil lead were used in the model, predicted and observed mean blood lead levels and distributions were essentially identical. Figure 2 shows that when default estimates of dust and soil lead were used in the model, predicted mean blood lead levels were within 2% of observed.

The Lead Exposure Subcommittee of the Clean Air Scientific Advisory Committee (CASAC) has "unanimously" agreed that the OAQPS document, "Review of the National Ambient Air Quality Standards for Lead: Exposure Analysis Methodology and Validation" (U.S. EPA, 1989a, which describes the IU/BK model) is scientifically adequate for use in the standard setting process for lead as an ambient air pollutant. The CASAC endorsed the opinion of its subcommittee in a recent letter addressed to U.S. EPA Administrator William Reilly (U.S. EPA, 1989a).

In addition, the recent "Technical Support Document on Lead" (U.S. EPA, 1989b), prepared by the U.S. EPA Office of Health and Environmental Assessment, stated that the IU/BK model "provides a useful and versatile method for exploring the potential impact of future regulatory decisions regarding lead levels in air, diet, and soil." The authors observe that the use of the IU/BK model has revealed that dust and soil ingestion are the largest sources of lead exposure in 2-year-old children in areas near a lead point source in which air lead levels are typical for urban areas in the United States.

In its September 7 directive, EPA implies that models such as the IU/BK may only be used where extensive, long-term environmental and biological data are available for a site. The

Agency also states that blood lead testing should not be the "sole criterion for evaluating the need for long-term remedial action at sites that do not already have an extensive, long-term blood-lead data base." While long-term data are clearly desirable, their absence or incompleteness should not totally preclude use of models such as the IU/BK. Indeed, it seems that if the Agency is concerned about remedial action decision-making in the face of limited data, it should encourage the use of models such as the IU/BK. In particular, to the extent that any blood lead data are available, they could be used to validate the assumptions used in the IU/BK model. The empirical data and modeling results together would provide insights into the site-specific relationships between soil concentrations and blood lead levels, yielding a stronger base for assessing appropriate soil cleanup levels.

In summary, the advantages to using the IU/BK model for establishing soil guidelines are that the model: incorporates flexibility in approaches to regulating exposures to lead, allows for the use of the most current site-specific data, results in the prediction of population distributions of blood lead concentrations, can provide a stronger basis for evaluating site-specific relationships between environmental concentrations and blood lead levels, and is consistent with derivation of the NAAQS and MCL for lead, as well as approaches to assessing lead toxicity undertaken by other groups.

3.3 Consideration of Differences in Bioavailability and Outdoor/Indoor Transfer of Lead from Different Sources

In the case of lead, most information on the relationship between blood lead and lead in soils is derived from studies conducted in urban communities or communities with operating smelters. As discussed above, based largely on these types of studies, the U.S. Centers for Disease Control (CDC) has suggested that when soil lead concentrations exceed 500-1,000 ppm, children's blood lead levels may increase above background levels (U.S. DHHS, 1985). The current literature suggests, however, that children living in mining towns without a recent history of smelting activities do not suffer from elevated blood lead concentrations. Particle size, lead species, and soil characteristics appear to be the primary factors behind this noted difference in impacts of soil lead from mining versus smelter sites on blood lead levels in children (Chaney, 1988). These factors appear to influence lead bioavailability and patterns of lead transport and exposure.

Studies have shown that dissolution of lead in the gut is a function of the surface-to-mass ratio associated with particle size (Steele et al., 1989; Healy et al., 1982; Barltrop and Meek, 1979). The larger the particle size, the smaller the relative surface area, and the lower the bioavailability. The influence of particle size on intestinal absorption was found to be especially important with particles $< 100\ \mu m$ in diameter (Barltrop and Meek, 1979). The particle sizes of a variety of tailings materials from different ores have been measured in the range of 10 to 1,000 μm with none smaller than 1 μm (Andrews, 1975). In contrast, primary particles emitted from smelters fall in the 1 to 3 μm size range, with a significant number of particles smaller than 1 μm (Perera and Ahmed, 1979).

Lead species is another critical factor in determining bioavailability. For example, animal toxicology studies show that some lead species are absorbed to a lesser extent than others. Lead sulfide is significantly less absorbed than lead acetate and lead oxides (Barltrop and Meek, 1975). Sampling data have demonstrated that mine waste lead is mostly in the form of lead sulfide, a species of lower availability. By contrast, most lead in street dust is in the sulfate, halide, or oxide forms (Duggan and Williams, 1977).

Another factor which appears to reduce the bioavailability of lead in mine waste is the binding effect of the surrounding soils and rock matrix. The natural binding effect of lead in soils is enhanced in the case of mine waste or galena tailings, by the rock matrix surrounding the residual lead. In galena, the lead sulfide is embedded in a rock matrix, typically quartz. This rock matrix appears to reduce significantly the lead that is available for dissolution in the stomach (Bornschein, 1988). For example, recent reviews of the impact of soils on the bioavailability of lead (Steele et al., 1989; Chaney et al., 1988) have shown that while powdered lead sulfide is essentially as available as more soluble forms of lead, lead sulfide is likely to be much less bioavailable when found in mining wastes.

The transfer of lead in soils to housedust has also been observed to vary according to the source of the lead, yielding different exposure patterns. For example, in urban settings or areas with operating smelters, indoor dust concentrations were similar to soil concentrations (U.S. EPA, 1986). In mining studies, however, indoor dust concentrations were less than soil concentrations, varying from about 15 to 45% of the soil concentration when soil concentrations were greater than about 500-1000 ppm (Barltrop, 1975; Barltrop, 1988; Davies et al., 1985). At lower soil concentrations, housedust concentrations were often similar to or greater than soil concentrations, probably reflecting the predominance of indoor sources of housedust lead (e.g., paint) at lower soil concentrations.

Possible reasons for lower housedust lead concentrations in mining communities include the fact that in urban communities and/or communities with operating smelters, lead from deposition of airborne lead is more pervasive on soil surfaces, and thus is more available to be tracked into homes. In addition, airborne lead can penetrate buildings and contribute to housedust lead concentrations in this manner. Such differences are due in part to particle size. In particular, the particle size of mine wastes is sufficiently large that airborne particles from a mine waste source tend to settle out quickly and do not deposit in as broad an area as the smaller aerosols from stack air emissions, which stay airborne longer and travel farther (Davies and Wixson, 1985; Lagerweff and Brower, 1975). Larger particles are also less likely to enter homes and thus to contribute to house dust concentrations of lead.

In summary, in establishing soil guidelines for a contaminant, site-specific and contaminant-specific characteristics must be considered. The source and type of lead present at a specific site can influence both its bioavailability and its distribution in the environment, and resulting human exposures. Such factors would strongly influence development of appropriate cleanup levels.

3.4 Consideration of Site-Specific Issues

As acknowledged by EPA, site-specific considerations may require derivation of different soil cleanup levels than those proposed by the Agency. If the approaches suggested above were adopted, it is not clear that any generic cleanup levels would be either necessary or appropriate. Site-specific factors to be considered would include the form of lead present at a site (e.g., lead from mining activities versus lead from smelting activities with impacts as described above) and characteristics of the surrounding population (e.g., its proximity and demographics).

Although the current interim guidance is described as being appropriate for "residential settings", other types of sites (e.g., industrial, commercial, or agricultural) may also require establishment of soil cleanup levels. Other site uses (either current or future) would necessitate different considerations in setting cleanup levels, such as different population subgroups of primary concern, different exposure pathways of concern, or different durations of exposure to site contamination. For example, children are unlikely to have much if any exposure to lead-contaminated soils at industrial sites. Thus, a different population subgroup, such as workers, is likely to be of primary concern for these sites. Childhood exposure to commercial sites would be determined in part by their proximity to residential areas, and would occur to a lesser extent than residential exposures. For non-agricultural rural lands (for example, parks, open space), risk would need to be determined in much the same way as for commercial property. Food chain exposures are likely to be of primary concern for agricultural lands. Adoption of procedures which allow for easier incorporation of these considerations into soil cleanup level derivation would result in cleanup standards which better reflect actual risks.

Conclusions

In summary, EPA's interim guidance provides inadequate documentation of the rationale and bases for the soil lead guidance levels proposed by the Agency. Their guidance neither uses the CDC soil values as intended by CDC nor acknowledges the substantial technical database available for setting soil lead cleanup levels. This lack of basis for their guidance levels casts doubt on the validity of the values proposed by EPA and provides no clear method for incorporating site-specific considerations into the setting of soil cleanup levels for specific lead-contaminated sites.

The generic values proposed by EPA should be replaced by a systematic process which incorporates the substantial amount of information which is available on lead toxicity, uptake, and body burden. This process would include use of the IU/BK model (or similar models incorporating information on the relationships between environmental and body burden concentrations of lead, such as that under development by SEGH) as well as consideration of such critical factors as the bioavailability of different forms of lead. The population of concern, target blood lead levels, and the fraction of the population to be protected by the soil cleanup levels should also be specified in a consistent way. Such an approach would both provide a scientifically valid basis for deriving soil cleanup levels and would allow for incorporation of site-specific and other considerations. The type of results generated by this approach would also assist in understanding more clearly the impacts of proposed remedies on reducing risks from lead exposure.

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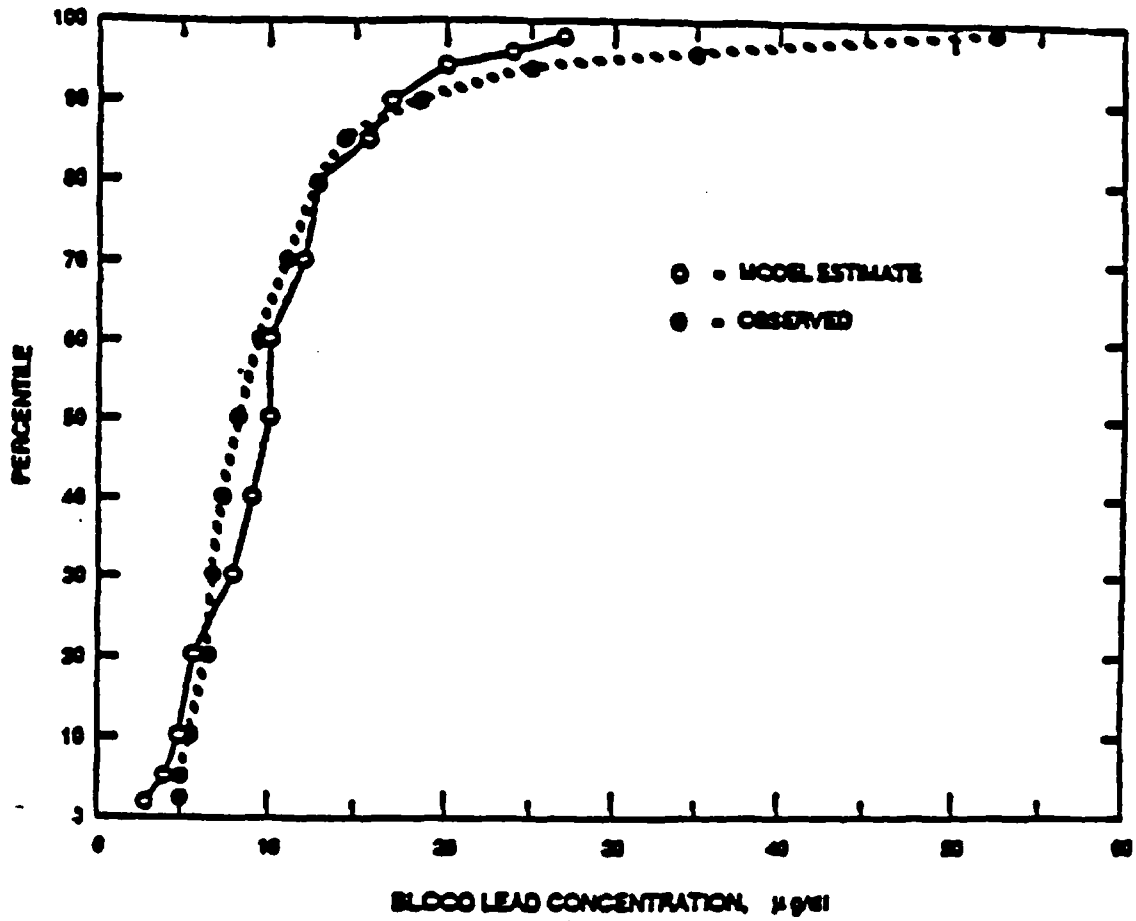

FIGURE 1

Comparison of Distribution of Measured Blood Lead Levels in Children, 1-5 Years of Age, Living Within 2.25 Miles of a Lead Smelter With Levels Predicted From the Uptake/Biokinetic Model. Measured Dust and Soil Lead Levels Were Included in the Input Parameters to the Model.

Source: U.S. EPA, 1989a

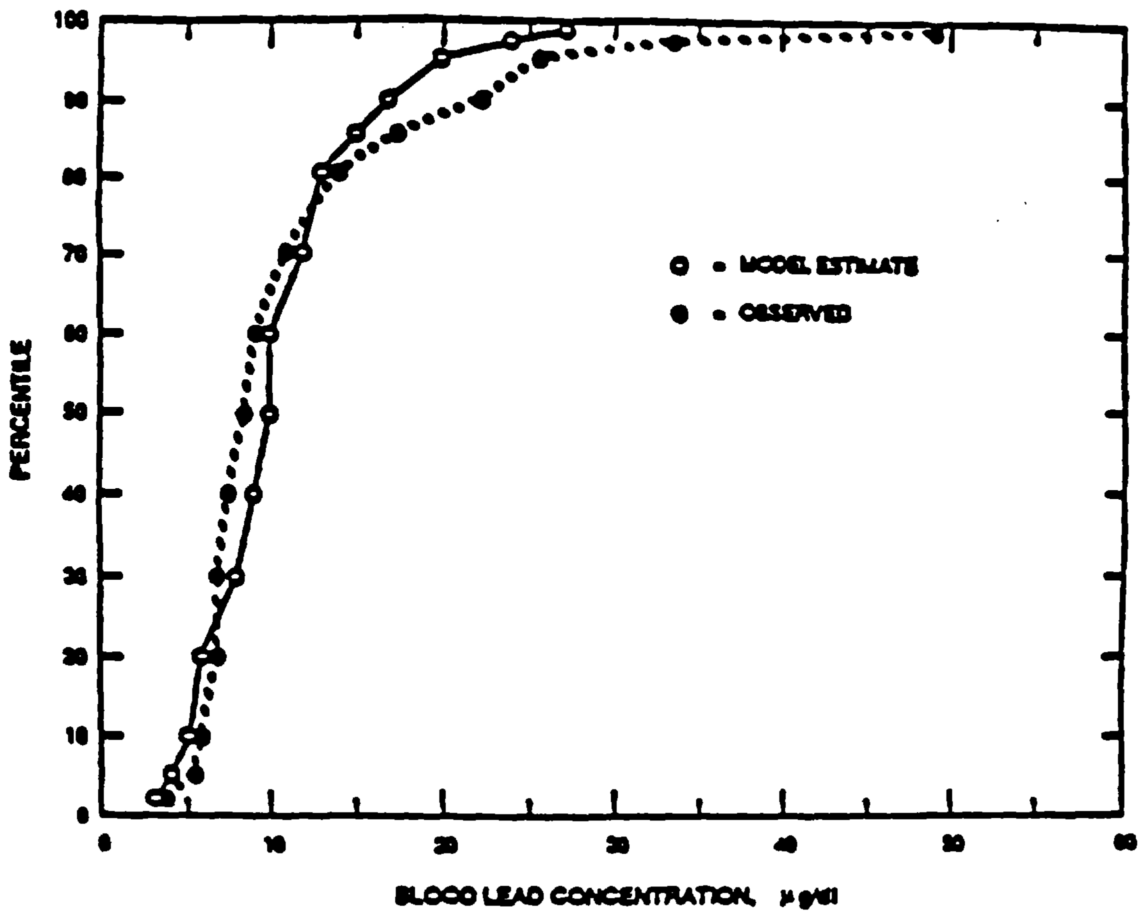

FIGURE 2

Comparison of Distribution of Measured Blood Lead Levels in Children, 1-5 Years of Age, Living Within 2.25 Miles of a Lead Smelter With Levels Predicted From the Uptake/Biokinetic Model. Dust and Soil Lead Levels Were Estimated Using Default Calculations.

Source: U.S. EPA, 1989a